



# Northeastern University

## College of Computer and Information Science

Re: Public comment for FCC NPRM WC Docket No. 17-108

August 29, 2017

To whom it may concern:

This comment is regarding the *Restoring Internet Freedom* NPRM released on May 23, 2017. My comment focuses on §IV.A, in which the authors seek to re-evaluate and eliminate the Internet conduct standard, as well as determine the need for several other rules passed as part of the *Open Internet Order*. Before going into the details of my public comment, let me explain a little about myself, why I am a subject matter expert, and what empirical data I bring to bear on questions posed in the NPRM.

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I am an Assistant Professor the College of Computer and Information Science at Northeastern University, a position that I have held since 2013. Before then, I was a postdoc at the University of Washington supported by an NSF/CRA Computing Innovations Fellowship. I received my M.S. and Ph.D. degrees in Computer Science from Northwestern University in 2006 and 2010, respectively. I have studied Internet performance and measured ISPs for the better part of a decade. I also have taught Computer Networking courses at the undergraduate and graduate level for four years.

Since 2014, my research team at Northeastern has measured *traffic differentiation*, *i.e.*, when an ISP selectively gives preferential or worse performance Internet traffic. This includes behavior such as blocking, throttling, or modifying network traffic; these practices are often referred to as net neutrality violations. Through a series of publications in highly respected, peer-reviewed conferences and workshops [3–5], my team has monitored and revealed such net neutrality violations in mobile networks in the US and abroad. We have also identified technical details regarding how ISPs implement traffic differentiation.

The research described in this comment has been funded by the National Science Foundation (award CNS-1617728) and a Google Faculty Research Award (unrestricted gift). Any opinions, findings, and conclusions or recommendations expressed in this comment are those of the author and do not necessarily reflect the views of the National Science Foundation or Google.

### **Comment on §IV.A.1 “Eliminating the Internet Conduct Standard”**

*“Does the [Internet conduct] standard benefit consumers in any way and, if so, how?”*

Answering these questions requires an experiment that analyzes broadband providers

immediately before and immediately after the rules took effect. Fortunately, the timing of our research on traffic differentiation [4] and the passage of the 2015 Open Internet Order provides us with exactly this experiment.

In late 2014 and early 2015, we studied mobile broadband providers to determine whether they were giving differential service to specific applications. We found that BlackWireless and SimpleMobile were selectively throttling traffic for YouTube, but not Netflix or any other video service we tested. In these cases, the difference in bandwidth given to YouTube was 65% compared to other video services. This indicates that certain content providers were unfairly discriminated against when it comes to offering high-quality video to their subscribers.

We further found that Boost Mobile *transcoded* YouTube video to lower resolution and cached the content in network. Transcoding is the process of changing the quality of content; *e.g.*, transcoding video in this case meant that the video was blurrier. *In other words, Boost Mobile modified network traffic destined for its users, without the consent of the edge provider, and did so in a way that made the quality of their video worse.* It did not do this to other video providers that we tested, thus making YouTube look less attractive. Not only were consumers harmed by having impaired access to a popular video provider, YouTube was also harmed by these practices because their competitors were given the ability to stream higher quality video.

Importantly all of these behaviors ceased after the FCC’s Open Internet Order was passed, according to tests in August, 2015. This shows that the OIO immediately caused such practices to decrease and directly improved the quality of service for consumers and content providers.

*“Is there a need for any general non-discrimination standard in today’s Internet marketplace? If so, what would that general non-discrimination standard be?”*

Yes, there is a need for a non-discrimination standard. Our empirical evidence described above supports the claim that a lack of this standard will lead to selective discrimination [4]. In fact, we found that this kind of discrimination cannot, at a fundamental level, apply equally to all content providers [5]. The reason is that Internet traffic does not declare itself as “video,” “voice over IP,” or “Web browsing”—rather, ISPs that discriminate against certain types of traffic must guess the application that generated it. Sometimes these guesses are wrong, meaning a video provider is not throttled while other are throttled, or non-video content is throttled when it should not be.

The end result is that unchecked discrimination will cause harm via unfair competition among content providers and lower quality Internet experiences for users. The Open Internet Order, while not perfect, provided a reasonable standard.

For example, the Internet Conduct standard gives ISPs a set of guidelines to judge the appropriateness a new policy impacting network traffic for subscribers. The rule also allows for policies that constitute reasonable network management, which by definition is not a burden for ISPs. Namely, if there is an engineering basis for a policy that impacts network traffic (*e.g.*, throttle *all* of a subscriber’s traffic, regardless of application, when the network is overloaded), then it will satisfy reasonable network management. Without such a rule, there would be nothing to judge such policies, adding confusion to regulatory

compliance instead of removing it.

**Comment on §IV.A.2 “Determining the Need for the Bright Line Rules and the Transparency Rule”**

*“Beyond the few, scattered anecdotes cited by the Title II Order [sic, refers to Open Internet Order], have there been additional, concrete incidents that threaten the four Internet Freedoms sufficient to warrant adopting across-the-board rules?”*

Yes, as stated in the previous section, we found numerous concrete instances of application-specific throttling and/or transcoding in the U.S. in 2015. These include Black Wireless, Simple Mobile and Boost Mobile. In 2016 and 2017, both our research team and independent investigators have found that T-Mobile, AT&T, and Verizon have engaged in video throttling, in some cases limiting video quality from popular services to quality levels lower than 480p [1–3].

*“When is “throttling” harmful to consumers? Does the no-throttling rule prevent providers from offering broadband Internet access service with differentiated prioritization that benefits consumers?”*

Throttling is harmful to consumers as described in the response to §IV.A.2. Namely, the quality of video they receive is impaired. Further, we find that when ISPs impose throttling, they do not apply it equally to applications, putting some applications at a disadvantage compared to their competition. In addition, our study of T-Mobile’s Binge On [3] program identified the potential for collateral damage, where non-video traffic can be impaired by the throttling practice even if that was not the broadband providers intent.

Not all throttling is harmful to consumers. For example, a reasonable way to manage a network is to throttle *all* of a consumer’s traffic, regardless of application, only when the network is overloaded. Instead of singling out any one application, this policy is both fair to all applications and prevents any one consumer’s application from taking more than its fair share of capacity from another consumer’s application.

However, this is not what we see in practice. Instead, we observe that video-specific throttling occurred regardless of time of day or location and thus was unlikely in response to overloading.

More generally, there is harm when an ISP unilaterally determines what to throttle without giving consumers a choice as to how and when throttling impacts their applications. Putting control in the hands of consumers mitigates such harms. The existing rules from the Open Internet Order provide such control for consumers.

*“Does the no-throttling rule harm latency-sensitive applications and content?”*

Absolutely not. First, rules cannot harm applications, nor do they impact latency. Rather, latency is affected by a wide range of factors not easily captured by the network management practices that conform to any one rule.

That said, the question seems to presume that prohibiting application-specific throttling necessarily increases latency for other applications. This is false. First, latency increases

only when Internet traffic traverses a router where demand exceeds capacity. In this case, packets are queued, which can increase latency on the path. While common, such queuing is isolated and transient—if it weren’t, the Internet would grind to a halt. The reason is that nearly all Internet traffic uses protocols that adjust their demand on the network in response to available capacity.

Further, note that throttling is the wrong approach to meet the needs of latency-sensitive applications when demand on the network exceeds capacity. Instead of throttling, latency-sensitive content (Web, VoIP) should be prioritized over latency-insensitive traffic. Because the former typically uses little bandwidth, prioritizing it does not harm the latter—providing a win-win scenario for consumers using an ISP with a diverse application mix.

*“We seek comment on current traffic delivery arrangements online.”*

Note that the NPRM authors are conflating two entirely orthogonal concepts. Paragraph 83 refers to arrangements to move content closer to consumers to improve performance. This is not paid prioritization. Paid prioritization refers to an ISP giving priority to certain traffic as it enters and traverses their network. These two concepts at a technical level are entirely different, and the topics in paragraph 83 are irrelevant in the context of a discussion of paid prioritization.

*“We seek comment on whether to keep, modify, or eliminate the transparency rule.”*

Disclosure requirements are the only ways that consumers and regulators can ensure that ISPs are providing the services that consumers pay for, and that those services are compliant with regulations. In fact, transparency rules can be implemented in a more rigorous and streamlined way. Specifically, regulations should be designed such that compliance can be measured empirically. By building specific network tests for compliance into regulations, network providers, consumers, and regulators can immediately and automatically determine the legality of a network provider’s policies. This could also vastly simplify and streamline processes for filing and responding to complaints.

Our research showed that deep packet inspection (DPI) devices remain prevalent in mobile broadband access networks [3–5], but there is a gap between the policies that providers disclose (e.g., throttle all video traffic) and the DPI implementations (e.g., throttle only certain targeted video traffic). We recommend that any deployed DPI devices (or similar traffic classification devices) must be disclosed to consumers, application providers, and regulators. The classification criteria (i.e., the matching rules) must also be public so that affected parties can evaluate their impact.

Without such details, current disclosures can be misleading. For example, T-Mobile and Verizon currently offer plans that throttle video traffic but our results indicate that not all video services are throttled. Specifically, Netflix and YouTube are throttled but not Vimeo. This level of detail is not provided in plan disclosures.

I believe that such disclosures are not only important, but also as easy to do as deploying the DPI devices that implement them. Thus, I argue that they do not constitute a regulatory burden.

## Summary and conclusion.

My team's research provides direct empirical evidence of harms to consumers before the passage of the Open Internet Order, remedies immediately after the rule was passed, and the resurgence of practices that may harm consumers again. It is my belief that dismantling these rules will directly harm users, as it is likely that harmful behavior that existed before the Open Internet Order will return.

For more technical details about our studies, I refer the reader to the publications listed at the end of this document. Network traces and analysis code that we used to inform our publications and conclusions are publicly available, linked from <http://dd.meddle.mobi>.

Sincerely,

A handwritten signature in black ink, appearing to read "David Choffnes". The signature is fluid and cursive, with a large initial "D" and a stylized "C".

David Choffnes  
Assistant Professor  
College of Computer and Information Science  
Northeastern University

- [1] J. Brodtkin. Verizon accused of throttling Netflix and YouTube, admits to “video optimization”. <https://arstechnica.com/information-technology/2017/07/verizon-wireless-apparently-throttles-streaming-video-to-10mbps/>, July 2017.
- [2] D. Choffnes, P. Gill, and A. Mislove. An empirical evaluation of deployed DPI middleboxes and their implications for policymakers. In *Proc. of TPRC*, 2017.
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- [4] A. M. Kakhki, A. Razaghpanah, A. Li, H. Koo, R. Golani, D. R. Choffnes, P. Gill, and A. Mislove. Identifying traffic differentiation in mobile networks. In *Proc. of IMC*, 2015.
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